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1,004,522

PATENT SPECIFICATION

NO DRAWINGS

1,004,522

Inventor: JACK PALMER SAVAGE.

Date of filing Complete Specification: Nov. 18, 1963.
Application Date: Nov. 19, 1962. No. 43744/62.
Complete Specification Published: Sept. 15, 1965.

Index at acceptance:—A2 D(2B2, 2X6, 3B); A2 Q(7B, 11, 16B2, 16D, 16X)
Int. Cl.:—A 23 l /20

COMPLETE SPECIFICATION

Dehydration of Vegetables

ERRATA

SPECIFICATION No. 1,004,522
Amendment No. 1

Page 1, line 46, *for* "former" *read* "formed"
Page 3, lines 61 and 62, *for* "mechapically" *read* "mechanically"
Page 4, line 43, *for* "10.6 diameter" *read* "10.6 mm. diameter"
Page 5, line 119, *for* "UNILIVER LIMITED" *read* "UNILEVER LIMITED"

THE PATENT OFFICE
7th October 1965

not been treated according to the invention.

The invention provides a process for the drying of pulses of high maturity, in which process the pulses are impregnated with a solution of an edible readily water-soluble material and are subsequently submitted to a drying operation. For the sake of brevity, in this Specification edible readily water-soluble material will be called "hydrophilic material."

The process of the invention has special significance in relation to the drying processes described in the Specification of our British Patent No. 783,974, which describes a process for drying pulses in which, before any drying treatment at all, or at least before drying has proceeded to a stage at which the pulse skin has lost its pliability, the skin is ruptured as by pricking or slitting. By the process of British Patent 783,974 one can obtain dried pulses which rehydrate relatively quickly, so that they need less time to be made tender enough to eat.

In order to obtain from a given batch of

[P.

drying of pulses of high maturity, comprising perforating the skin of the pulses before completion of the drying step and then completing the drying, in which process, at a stage before drying has been completed, the pulses are impregnated with a solution of a hydrophilic material.

The maturity of a pea is usually indicated by its "Tenderometer Value" (T.V.), which is a measure of the resistance of the tissue of the fresh pea to a crushing force as determined on a standard F.M.C.* tenderometer. For the purposes of this Specification a high maturity pea is one having a T.V. greater than 110. In practice, of course, a Tenderometer Value is an "average" value, found by making measurements on a large number of pulses (for example, 1,000) together. High maturity broad beans are those having a sugars content of less than 10% by weight of the total bean solids.

The hydrophilic material employed is preferably a polyhydric alcohol, for example sucrose (cane sugar) or glycerol.

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No initial drying

COMPLETE SPECIFICATION

Dehydration of Vegetables

We, UNILEVER LIMITED, a Company registered under the laws of Great Britain, of Port Sunlight, in the County of Chester, England, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to the drying of vegetables, more particularly pulses such as peas and broad beans, and is concerned with modifying drying processes so that the product obtained rehydrates more quickly.

It is well known that pulses of high maturity, when dehydrated, do not rehydrate so rapidly or completely as those of low maturity.

We have now discovered that pulses of high maturity can be dried to give dehydrated pulses which will rehydrate more quickly than pulses of similar maturity that have not been treated according to the invention.

The invention provides a process for the drying of pulses of high maturity, in which process the pulses are impregnated with a solution of an edible readily water-soluble material and are subsequently submitted to a drying operation. For the sake of brevity, in this Specification edible readily water-soluble material will be called "hydrophilic material."

The process of the invention has special significance in relation to the drying processes described in the Specification of our British Patent No. 783,974, which describes a process for drying pulses in which, before any drying treatment at all, or at least before drying has proceeded to a stage at which the pulse skin has lost its pliability, the skin is ruptured as by pricking or slitting. By the process of British Patent 783,974 one can obtain dried pulses which rehydrate relatively quickly, so that they need less time to be made tender enough to eat.

In order to obtain from a given batch of pulses a dried product which is former by individual pulses substantially all of which will rehydrate satisfactorily within a conveniently short time (after boiling in water for, say, 15 minutes) the process of British Patent No. 783,974 is in practice applied only to those pulses in the batch which are of low to medium maturity—that is, normally only the smaller pulses; the larger, more mature pulses are separated from the batch and used otherwise, for example, for canning.

In one of its aspects, therefore, the present invention widens the field of applicability of the drying process described in British Patent No. 783,974 in that it enables that process to be applied not only to pulses of low to medium maturity but also to pulses of higher maturity, which would ordinarily be used for purposes other than drying.

According to one aspect of the invention, then, there is provided a process for the drying of pulses of high maturity, comprising perforating the skin of the pulses before completion of the drying step and then completing the drying, in which process, at a stage before drying has been completed, the pulses are impregnated with a solution of a hydrophilic material.

The maturity of a pea is usually indicated by its "Tenderometer Value" (T.V.), which is a measure of the resistance of the tissue of the fresh pea to a crushing force as determined on a standard F.M.C.* tenderometer. For the purposes of this Specification a high maturity pea is one having a T.V. greater than 110. In practice, of course, a Tenderometer Value is an "average" value, found by making measurements on a large number of pulses (for example, 1,000) together. High maturity broad beans are those having a sugars content of less than 10% by weight of the total bean solids.

The hydrophilic material employed is preferably a polyhydric alcohol, for example sucrose (cane sugar) or glycerol.

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In some cases, for example when the hydrophilic material has a particularly noticeable taste which might be considered undesirable, it may be preferred to impregnate the pulse with a mixture of two or more different hydrophilic materials chosen, for example, so that the taste of one masks that of the other, or otherwise makes it less objectionable. Thus, when sucrose is employed in large amount it is sometimes found to impart too sweet a taste to the pulses, and one way to overcome this disadvantage is to impregnate the pulse with a mixture containing sucrose and common salt (sodium chloride). Similarly, when particular flavour effects are desired these may often be obtained by impregnating the pulse with hydrophilic material or a combination of hydrophilic materials having a suitable flavour.

* F.M.C.—Food Machinery and Chemical Corporation.

The preferred temperature of impregnation is from 90°C. to the boiling point of the solution under atmospheric pressure. Actual boiling or simmering of the impregnating solution should normally be avoided so as to reduce the separation of the pulse skins from the cotyledons within them, although we have discovered that boiling of the solution may safely occur if the pulses are submitted to partial dehydration to, say, 50% moisture content, prior to impregnation.

Particularly satisfactory results are obtained by keeping the impregnating solution at a temperature in the range 90° to 95°C. However, if air is removed from within the pulses during impregnation (as by reducing the pressure on them), impregnation is facilitated, and considerably lower temperatures can be used.

The hydrophilic material will usually form from 15% to 60%, and preferably from 20% to 40% by weight of the impregnating solution. In general, the treatment time should be at least such as to allow the solution to pass the pulse skin and diffuse well into the cotyledon; but it should not be so prolonged that the pulses are made unduly tender. Diffusion of the impregnating solution into the cotyledons is facilitated if the pulse skin is perforated prior to impregnation.

More mature pulses need a longer impregnation time than do those of lower maturity; when the pulses to be treated are peas it is found that it is the larger peas that are normally of high maturity, and it is convenient to separate these from those of low maturity by sieving. However, it may be that the larger peas so separated are of such a wide range of "over-maturity" that further separation into fractions of more limited maturity range is desirable since an excessively high content of hydrophilic material can produce undesirable texture characteristics. This separation can conveniently be done by density grading in suitable solutions, for example in brine.

As an indication of the variations of impregnation times with maturity, we give the following for peas (for an impregnation bath containing 30% sucrose and under atmospheric pressure).

	T.V.				
	110	120	130	140 - 150	160 and over
Solution Temperature (°C)	90 - 95	90 - 95	90 - 95	90 - 95	90 - 95
Immersion Time (Min.)	7 - 8	15 - 18	25 - 27	30 - 35	40+

As a guide, it will generally be found that a pulse having a total content of hydrophilic material (including that in the pulse before impregnation) from 30% to 50%, and preferably from 35% to 45% by weight of the total solids content will rehydrate satisfactorily. The immersion times set out above are intended to give such a level in peas.

The drying step can be performed by any conventional means, but most suitably by drying in a stream of warm or hot air. After impregnation the drying temperature employed can be high (for example, 110°C. to 160°C.) in comparison with temperatures normally employed for pulses, because pulses treated according to the invention show a reduced tendency for chemical changes such as browning to occur at high temperatures. It is often advantageous to use high drying temperatures because dehydration then proceeds rapidly. Moreover, the use of a high drying temperature leads to the development of an open structure in the pulse, and this markedly facilitates rehydration.

The invention is illustrated by the following Examples, in which the "%" given represents percentage by weight.

EXAMPLE 1

This Example illustrates the improvement that can be obtained by applying the invention to unpricked peas of relatively high maturity.

A batch of peas of the variety "Dark Skinned Perfection" was washed and separated into two fractions by means of a sieve having holes of 10.6 mm. diameter. The fraction retained by the sieve had a T.V. of 130. This fraction was given a conventional blanching treatment (1 minute immersion in a hot (98°C) aqueous solution containing 0.4% Na_2SO_3 and 0.4% Na_2CO_3). After rinsing, the blanched peas were divided into two lots, A and B, and treated separately as described in (a) and (b) below.

(a) the peas forming lot A were soaked for 25 minutes in a solution, maintained at about 90°C, containing 30% sucrose (this solution also contained 2% common salt to aid penetration of the sugar and 0.04% Na_2CO_3 and 0.2% Na_2SO_3 to reduce loss of colour during drying and storage).

After this impregnation, the peas were drained for 5 minutes and then air-dried to a moisture content of 8% in a through up-draught drier at a temperature of 50°C.

The dried peas were almost as large as they had been when fresh, they had an attractive colour and the skin was only slightly wrinkled.

The peas were rehydrated by cooking for 25 minutes in boiling water; after draining they were plump and fresh looking and had a satisfactory texture.

(b) For purposes of comparison, the peas forming lot B were treated generally as described in (a) except that soaking in sucrose solution was omitted.

The dried peas were much smaller and had a less attractive appearance than those in (a). After cooking for 25 minutes in boiling water, rehydration was obviously incomplete; the drained peas had a wrinkled skin and a hard texture.

EXAMPLE 2

This Example illustrates a preferred embodiment of the invention and shows the improvement that can be obtained by applying the invention to the drying of pricked peas of relatively high maturity.

A batch of peas of the variety "Dark Skinned Perfection," having a T.V. 125, was washed and separated into two fractions by means of a sieve having holes of 10.6 mm. diameter. The fraction retained by the sieve had a T.V. of 139. This fraction was divided into two lots C and D which were treated separately as described in (c) and (d) below.

(c) The peas forming lot C were mechapically pricked with prickers (pins) of 1.25 mm. diameter. After blanching and rinsing the peas were soaked for 30 minutes in a solution, maintained at about 90°C, containing 30% sucrose, 2% common salt, 0.04% Na_2CO_3 and 0.2% Na_2SO_3.

After this impregnation, the peas were drained for 5 minutes and then air-dried in a through up-draught drier to a moisture content of about 8%. Drying was carried out in two stages, dehydration to about 30% moisture with an air speed of 3 metres per second (m.p.s.) and a temperature of 65°C; and from 30% to 8% moisture with an air speed of 1 m.p.s. and a temperature of 50°C.

The dried peas were almost as large as they had been when fresh; they showed little wrinkling of the skin, and had an attractive colour.

The peas were rehydrated by cooking for 15 minutes in boiling water; after draining they were plump and fresh looking and they were tender throughout without being excessively soft.

The total content of sugars (comprising not only those sugars added as above, but also such sugars as the pulses contained before the impregnation step) of these peas, on a dry solids basis, was 41%; of this, 29% was in the cotyledons and 12% in the skin.

(d) For purposes of comparison, the peas forming lot D were treated generally as described in (c), except that no soaking step was employed. The peas obtained after drying were only about two-thirds the size of the fresh pulses, and had the characteristic wrinkled appearance of ordinary dried pricked peas.

The peas were cooked for 15 minutes in boling water. After draining, they had a less attractive appearance than the sugared sample, and a very large proportion of them was found to have a hard core of tissue in the cotyledons, showing the rehydration was not complete.

The total sugars content of the unsugared peas, on a dry solids basis, was 18%, the cotyledons containing 13% and the skin 5%.

EXAMPLE 3

A low maturity batch of peas, of T.V. 98, were treated generally as described in Example 2 (c) above. After rehydration the peas were found to have a very soft "mushy" texture, which was very unappetizing, and were rather sweet.

EXAMPLE 4

This Example illustrates the low temperature impregnation of high maturity peas.

Peas of the variety "Dark Skinned Perfection." of T.V. 135, were treated as described in Example 2 (c), except that the soaking in sugar solution was carried out at 20°C. for 4 hours.

After drying the peas were found to contain

51% of sugar on a dry solids basis, and after rehydration they had an excellent texture.

EXAMPLE 5

This Example illustrates the application of the invention to peas that were partly dried before the sugar impregnation treatment.

A sample of peas having T.V. of 139 was obtained and pricked as described in Example 2. These peas were blanched in a hot (98°C) aqueous solution containing 0.5% of Na_2CO_3 and 0.7% Na_2SO_3 (a higher level of Na_2SO_3 being used than in the previous Examples, where further sulphite was added in the sugar treatment before drying). The blanched peas were dried to 50% of the blanched weight in a through up-draught drier at about 50°C, with an air speed of 3 m.p.s. The peas were then soaked in a hot solution (90°C) containing 30% sugar, 2% common salt, 0.04% Na_2CO_3 and 0.2% Na_2SO_3 for 30 minutes and, after draining, dried in a through up-draught drier as in Example 2.

The dried sugared peas obtained were indistinguishable from those prepared in Example 2 and after cooking for 15 minutes in boiling water gave plump, fresh looking peas which were tender throughout.

The total sugars content of these sugared peas on a dry solids basis, was 44%, distributed as follows: cotyledons—26%; skin—18%.

EXAMPLE 6

This Example illustrates the high temperature (110° to 160°C) dehydration of peas treated according to the process of the invention.

A batch of peas of the variety "Dark Skinned Perfection," having a T.V. 120, was washed and separated into two fractions by means of a sieve having holes of 10.6 diameter. The fraction retained by the sieve had a T.V. of 122. This fraction was divided into three lots G, H and J which were treated separately as described in (g), (h) and (j) below.

(g) The peas forming lot G were pricked, blanched and rinsed as in Example 2. They were then soaked for 15 minutes in a hot solution (90°C) containing 30% sucrose, 2% common salt, 0.4% Na_2CO_3 and 0.2% Na_2SO_3. The peas were drained and then dried to about 35% moisture in a through up-draught drier at 160°C with an air speed of 3 m.p.s. This took about 6 minutes. Reduction of the moisture content from 35% to about 8% was carried out with an air speed of 1 m.p.s. and at a temperature of 50°C.

The dried peas were almost as large as they had been when fresh, with an attractive strong green colour and a light-coloured, open, porous internal structure.

The peas were rehydrated by cooking for 4 minutes in boiling water. After draining they were plump and fresh looking and they were tender throughout without being excessively soft.

(h) For purposes of comparison, the peas forming lot H were treated exactly as described in (g), except that the first stage of drying (down to a moisture content of about 35%) was carried out in a through up-draught drier at 65°C. This stage took about 2 hours.

These dried peas were similar in external appearance to those obtained in (g), but the cotyledons were denser and darker.

The peas rehydrated completely in 15 minutes in boiling water; however, when rehydration was interrupted after only 4 minutes cooking most of the cotyledons were hard and incompletely rehydrated, but the skins were quite soft.

(j) In a further comparative experiment the peas forming lot J were pricked and blanched in a hot aqueous solution (98°C) containing 0.5% Na_2CO_3 and 0.7% Na_2SO_3. The blanched peas were then dried as described in (g).

The dried peas were pale green, they were very wrinkled and many of them showed scorched brown areas.

EXAMPLE 7

This Example illustrates the impregnation of mature peas with sugar, under reduced pressure.

A batch of peas of the variety "Dark Skinned Perfection" were size graded and the more mature fraction of T.V. 150 were pricked and blanched in a solution containing 0.7% sodium sulphite and 0.4% sodium carbonate at 95°C for 75 seconds. The peas were then placed in a wire cage, with a perforated lid, and put into a container holding 30% sugar solution, maintained at 30°C. The ratio of sugar solution to peas on a volume basis, was 6:1.

The container was next placed in a vacuum cabinet and the pressure on the peas was reduced to 725 mm. mercury absolute pressure (during a vacuum impregnation cycle one minute was taken to reduce the pressure and half a minute to release the vacuum. Thus, a ten-minute cycle consisted of 1 minute to reduce pressure, eight-and-a-half minutes at the reduced pressure, and half-a-minute to bring the pressure back to atmospheric).

The peas were submitted to two vacuum cycles of 10 minutes each, after which they were removed from the container, drained for one minute and dried overnight in a cross-draught drier at 50°C.

After rehydration the peas were pleasantly

tender, and had a total sugar content of 42% on a dry solids basis.

EXAMPLE 8

This Example illustrates the application of the invention to broad beans.

A batch of broad beans of the variety "Triple White," (of sugars content of 5% on a dry solids basis) was washed and then divided into two fractions K and M which were treated separately as described under (k) and (m) below.

(k) The skin of the beans in the first fraction (K) was punctured with a thin blade so as to give a narrow slit about 1 mm. wide and 5 to 10 mm. long. The beans were blanched for 1 minute in a hot solution (98°C) of 0.5% Na_2CO_3 and 1.0% Na_2SO_3 and after rinsing they were soaked for 20 minutes in a hot solution (90°C containing 50% sucrose, 2% common salt, 0.04% Na_2CO_3 and 0.2% Na_2SO_3. After draining they were dried to about 8% moisture in a through updraught drier at 50°C.

The dried beans were almost as large as they had been when fresh; they had a pale green colour and the skin was smooth with only slight enlargement of the original slit. They were rehydrated by cooking for 25 minutes in boiling water and after draining they had a plump appearance, the skins were smooth and apparently unbroken and they had a very satisfactory texture.

The total sugars content of these beans, on a dry solids basis, was 44%; 25% in the cotyledons and 19% in the skin.

(m) For purposes of comparison, the beans forming the second fraction (M) were treated exactly as described in (k), except that the soaking step was omitted. The dried beans were slightly smaller than those obtained as in (k); they were paler, the skins were wrinkled, and many of the beans showed enlargement of the original slit.

After rehydration for 25 minutes in boiling water several of the beans had split and wrinkled skins, their colour was paler than the bean obtained in (k), and the texture was harder and somewhat uneven.

WHAT WE CLAIM IS:

1. A process for the drying of pulses, in which process pulses of high maturity are separated from those of lower maturity, and the pulses of high maturity are impregnated with a solution of hydrophilic material and are subsequently submitted to a drying operation.

2. A process according to Claim 1, in which the skins of the pulses are perforated before the drying of the pulses is completed.

3. A process according to Claim 2, in which the skins of the pulses are perforated prior to impregnation with the solution of hydrophilic material.

4. A process according to any of the preceding claims, in which the total amount of hydrophilic material in the dried pulses forms from 30 to 50% of the dry weight of the pulses.

5. A process according to Claim 4, in which the hydrophilic material in the pulses forms from 35 to 45% of the dry weight of the pulses.

6. A process according to any of the preceding claims, in which the high maturity pulses are peas of Tenderometer Value greater than 110.

7. A process according to any of Claims 1 to 5, in which the pulses are broad beans having a sugars content of less than 10% by weight of the total bean solids.

8. A process according to any of the preceding claims, in which the hydrophilic material is a polyhydric alcohol.

9. A process according to Claim 8, in which the hydrophilic material is sucrose.

10. A process according to any of the preceding claims, in which the temperature of the solution of hydrophilic material during impregnation is from 90 to 95°C.

11. A process according to any of Claims 1 to 9, in which the impregnation is carried out under a pressure lower than atmospheric.

12. A process according to any of the preceding claims, in which the impregnating solution contains from 15 to 60% by weight of the hydrophilic material.

13. A process according to Claim 12, in which the solution contains from 20 to 40% by weight of the hydrophilic material.

14. A process according to any of the preceding claims, in which the pulses are partially dried prior to impregnation.

15. A process according to any of the preceding claims, in which during the said drying operation the impregnated pulses are dried at a temperature between 110 and 160°C.

16. A process according to any of the preceding claims, and substantially as described in any of Examples 1, 2, 5 or 6.

17. A process according to any of Claims 1 to 15, and substantially as described in Example 4, 7 or 8.

18. Dried pulses prepared substantially as claimed in any of the preceding claims.

19. A foodstuff comprising pulses treated substantially as claimed in any of Claims 1 to 18.

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